

Business Process Based Analysis for e-Government Services Improvement

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Abstract—According to European and National studies Information and Communication Technologies in Public Administrations are mature enough to offer e-government services to citizens, business and other Public Administrations. Nevertheless a different perception is evident if e-government effectiveness, i.e. real usage by citizens, is considered. It seems to us that in the development of e-government solutions the focus has been put too much on technological aspects often forgetting to involve relevant stakeholders and domain-dependent requirements. Starting from a quality framework for Business Processes Management, which permits to assess a software system implementation with respect to a set of quality attributes related to cooperation and sharing that we had previously defined, we conducted a systematic survey considering eight case studies from different Italian administrative regions. The survey and the obtained results show the importance of putting in place a systematic analysis and assessment approach within Public Administrations to enable informed e-government development via a plan-do-check-act paradigm.

Index Terms—Business Process Management, e-government service, Quality, Information Systems.

I. INTRODUCTION

Innovation in Public Administration (PA) is really important for stimulating and inspiring governments in their reform efforts toward more inclusive development. Citizen's inclusion is one of the European objectives that are clearly addressed by the Europe 2020 growth strategy [1] for the coming decade. With a reference to the guidelines given by Digital Agenda for Europe we believe that organization issues has to be considered carefully with regards to Information and Communication Technology (ICT). Innovation can be reached by balancing the impact of technology and the changing in working practices.

Current maturity of ICT enables a relatively simple development and delivery of e-government services. European Commission studies show that 83% of basic e-government services are today available on-line [2]. Comparing these data with those reported by similar surveys in 2006 and 2007 [3], [4] it seems evident that PA interests in electronic services are quite strong and quickly raising. Nevertheless a different perception is evident if e-government effectiveness, i.e. real usage by citizens, is considered. In such a case statistics show that many of the available e-government services are seldom accessed and used by citizens. In [5] the authors recognize that practical experiences and researches confirm that e-government service acceptance is not guaranteed just by service

availability. Public approval is quite often below what developers expected. In other words citizens do not use e-government services just because they are on-line. Many different reasons contribute to the highlighted situation. Our impression, corroborated by past experience and studies, is that a systematic analysis and assessment approach strongly contributes to make the Public Administration aware of service delivery inefficiencies and supports the introduction of suitable action plans toward e-government effectiveness.

Resulting complexity of public sector scenario has to be considered and resolved. We believe that Business Process Management (BPM) is a suitable tool in such a context. It supports PA experts providing methods, techniques, and software to model, implement, execute and optimize organizational Business Processes (BP) which involve humans, software applications, documents and other sources of information [6]. Recent works show that process modeling has been identified as a fundamental phase in BPM.

The quality of BP resulting from the modeling phase is critical for the success of an organization. However, modeling process is a time-consuming and error-prone activity. Therefore, techniques, which help organizations to implement high-quality processes, and to increase process modeling efficiency, have become a highly attractive topic both for industries and for the academy. Certainly many different commercial tools have been developed to support BPM, nevertheless for what concerns the modeling phase they mainly provide support for BP editing and syntactical analysis.

In the paper we present an experience regarding the application of BPM in the modeling and improvement of e-government digital services with reference to real cases studies. In particular, we applied a qualitative evaluation approach focusing on process related domain-dependent requirements. The findings from eight inter-organizational case studies are introduced. They explore best practices related to the implementation of applicative cooperation in the context of the Italian local public sector.

The paper is structured as follows. In the next section we provide some background materials. In Section 3 we report on the methodological approach we have followed in our research. Section 4 presents the theoretical framework and than Section 5 the eight case studies. Finally Section 6 draws some conclusions on the role of systematic analysis and assessment in the Public sector.

II. BACKGROUND

BPM is as old as the discipline of industrial engineering. Localized implementations of process management (e.g. manufacturing processes, shipping processes, etc.) have been

prevalent for years [6]. Generally speaking the process management approach involves [7], [8] the following phases:

- 1) Documenting the process to obtain an understanding of how work flows through the process;
- 2) The assignment of process ownership in order to establish managerial accountability;
- 3) Managing the process to optimize some measures of process performance;
- 4) Improving the process to enhance product quality or measures of process performance.

In public sector, the primary benefit of BPM is the “increased effectiveness and efficiency achieved from restructuring the organization along cross-functional processes”. Other benefits were noted [9]:

- 1) By managing processes, the PA can better integrate perspectives and priorities with resource management (this is equivalent to the increased private sector focus on managerial accounting through activity-based management);
- 2) Many new management initiatives require process management, and it is impossible to implement process management concepts under the old industrial-age management models;
- 3) Process management opens the door for creative and innovative approaches to enhancing organizational performance;
- 4) Process management allows the effective implementation of modern systems and standard software; i.e. most new implementations are process-oriented.

We can conclude that a systematic design and analysis approach is needed to support innovation in PA and to enable informed e-government development via a plan-do-check-act paradigm.

III. RESEARCH DESIGN

Following we provide and discuss analysis and assessment activities carried on within the ICAR-Plus project under the coordination of the Marche Region with the scientific contribution of the University of Camerino. The Italian ICAR-Plus¹ project (2008-2010) is certainly the most relevant initiative with respect to monitoring, assessment and analysis of e-government digital services at the regional level. ICAR-Plus was designed as a supporting action to spread the culture of cooperation in all the Italian Regions as a result of the previous ICAR project. Among the other activities ICAR Plus analysed and assessed aspects related to technological issues and the impact of organizational changes in local Public Administrations. The result of these monitoring and evaluation activities provided useful information to the Regions to promote best practices. The ICAR-Plus project organization foresees a central coordination unit and twenty-one local nodes at the regional level. Local nodes worked in close cooperation with members of the central staff to establish and plan all the local activities.

The research draws upon two main phases both based on a qualitative research method [10].

In the first phase, we worked in cooperation with a focus

group and we asked to the members of the group about their attitude toward the impact of interoperability and applicative cooperation in already developed projects at regional level. The focus group composed by the central staff of the ICAR Plus project, Focal Points, project managers and IT architects of the Marche Region. In the group meeting we posed many questions to the participants leaving them a wide room for engaging in discussion with other group members, indeed encouraging as much the discussion within the focus group as possible. Successively a focus group on the specific topic composed by representative of each region and experts from the Marche region has been established. Objective of the focus group has been the discussion on the theoretical framework presented in Section 4 and on domain requirements, which were considered relevant in order to select the case studies for the evaluation activities.

In the second phase, a case study based approach [11] has been put in place. Thanks to the close collaboration with the Regions, it has been possible to gather information from a small set of case studies. In particular the experimentation included eight case studies chosen from those, which were considered the best practices in the different Regions. Interviews were conducted by the Focal Points of the ICAR Plus project with project managers and IT architects of each selected case study focusing on the process component and applicative cooperation issues highlighted by the focus group and detailed in Section 4. To complete the picture of the project the documentation has been reviewed and the base information transcribed. According to the work and the guidelines established by the Focal Points, the researchers carried on a detailed analysis of the interviews focusing on the more general result of the ICAR Plus project and other national and international surveys. As a result recommendations and guidelines toward a more systematic assessment approach have been defined.

IV. THEORETICAL FRAMEWORK

The choice of the case studies was supported by the “Work System Framework” proposed by Alter [12] adapted to the requirements of the Public Administration. The framework also guided case study analysis in each Region. The framework is based on the business process concept and it focus on elements typically related to an information system such as for instance participants, information, infrastructure and technology. Doing that we avoid getting lost in too much details and we focus on core aspects of the case study analysis. In particular, for each case we stress the role of Business Process. “A Business Process is a collection of related and structured activities undertaken by one or more organizations in order to pursue some particular goal. Within an organization a BP results in the provisioning of services or in the production of goods for internal or external stakeholders. Moreover BPs are often interrelated since the execution of a BP often results in the activation of related BPs within the same or other organizations” [13].

According to the framework it is important to identify the level of detail of the case study that has to be assessed defining then the scope of the evaluation activity. We refer to project related and service related evaluation.

- **Project.** It refers to the whole information system

¹ <http://www.progettoicar.it/Home.aspx>

related to a systemic action in PA. The result of the monitoring presents a general picture on the action.

- **Service.** It refers to a specific service that can be part of a wide project. The result of the monitoring is restricted to the target and the outcome limited.

The requirements we monitored in the cases have been developed taking into account the following aspects. Further detail on the requirements can be found in [14].

Coordination is a four level requirement concerning the capability of Public Administrations, involved in the execution of a project or a service, using different technologies in order to interact with other PAs to accomplish a common goal. The coordination requirement is structured according to the following levels: (i) *Lack of Coordination* in the case direct interactions between administrations are not precisely defined and established; (ii) *Communication* in the case a fully integrated electronic systems is missed and communication is implemented via regular mail or fax; (iii) *Collaboration* when involved PAs contribute with a fully automated business process; and (iv) *Semantic Integration* implements collaboration mechanisms enriched with semantic support.

Control is a three level requirement concerning activation policies suitable to drive the project or the service from its start to the final fulfilment. According to this classification we distinguish the following levels: (i) *Reactive* control in which the Administration always waits for a request from the citizen to activate the service (ii) *Proactive* control in the case the administration announces available services to possibly interested users; and (iii) *Creative* refers to the presence of activities related to the promotion of related, and maybe relevant, services.

Sharing is a two level requirement referring to the way in which the PA handles and shares citizen related data with other administrations according to its scope of responsibility and avoiding data redundancy and misalignment among PAs data storages. With respect to the sharing requirements the following levels are available: (i) *No Sharing* when the administration does not try to retrieve information from other PA which retain such information and instead it makes repeated request to the citizens for up to date information; and (ii) *Data Sharing* in the case automatic ways of retrieving citizen related data are implemented interacting with the PAs that are in charge of maintaining the needed information.

Transparency is a three level requirement suitable to monitoring the ability of the administration to make users aware of the project and service execution in term of activities and people in charge to govern it, improving citizens perceived trust and inclusion. According to this classification we distinguish three different levels: (i) *No Transparency* when the activities of a given service or project are not visible outside of PA offices; (ii) *Activity Aware* when the administration implements tracking mechanisms notifying citizens about the process flow; and (iii) *Role Aware* when activity aware transparency is implemented and enriched by the explicit identification of a civil servant responsible for the activity.

Inclusion is a three level requirement that considers the ability of the administration to provide service to the citizens taking into account their skills. According to this classification we distinguish the following different levels: (i)

Channel Inclusion refers to different ways that can be implemented to access the PA; (ii) *Profile Inclusion* refers to service capabilities aimed at supporting citizens physical diversities; and (iii) *Language Inclusion* refers to the ability of a PA to interact with people with different nationalities using different languages.

Simplification is a two level requirement that considers the ability of the Public Administration to reengineer the organizational infrastructure as well as the performance of legislative actions to simplify internal and external processes. According to this classification we distinguish the following different levels: (i) *Organization simplification* refers to a more efficient and effective tasks management to satisfy the needs of citizens and enterprises; (ii) *Legislative simplification* refers to a systematic improvement of the quantity of laws and regulations.

The requirements we defined are at the base of the proposed monitoring approach. They can be considered just as a starting point and certainly other domain dependent requirements can be identified in further researches.

V. CASE STUDIES

In this section we present the case studies we investigated. Regions contributed to this work with a case study are “Regione Marche”, “Regione Lombardia”, “Regione Sicilia”, “Regione Sardegna”, “Regione Friuli Venezia Giulia”, “Regione Umbria”, “Regione Basilicata” and “Regione Liguria”. The case studies present best practices at regional level and at the same time they contribute to validate the proposed monitoring approach.

A. “Regione Marche” —Agricultural Information System

The Marche Region selected the Regional Agricultural Information System (SIAR) as the most interesting best practice in the Region in the area of process re-engineering. Thanks to a close collaboration with the involved stakeholders the system has been developed in an iterative way supporting digital innovation starting from domain-requirements discovery to system development. Aim of the project is to introduce common rules and tools for the agricultural community in order to give them the possibility to apply for European Commission founding scheme using the developed ICT system. Users (or their intermediary) complete the application and activate different processes (such as “evaluation”, “founding”, etc.). For each process automatic and manual inter-administrations activities are fulfilled. The system takes advantage of Marche Region ICT applicative infrastructure such as Cohesion and “Carta Raffaello” (a CNS standard) for authentication and authorization and applicative cooperation infrastructure to implement interoperability. The IT infrastructure results to be an enabler to improve the effectiveness of organization.

For what concern the monitoring of the requirements the Agricultural Information System is implemented respecting national constraints and it can retrieve needed information **sharing** data related to land, building and animals, dossier of companies and fiscal information. Related to the coordination the **collaboration** level has been implemented. In particular, the SIAR ensures cooperation with the National Agricultural Information System. It is useful to avoid data

inconsistency and process misalignment. Related to the **control** level SIAR implements a reactive system. After the publication of the call the system permits to interested farmers to digitally submit the request for application. At the same time the farmers will be able to track the application. On-line presence is guaranteed without any level of **inclusion**. Finally, with regards to the simplification Marche Region supports the innovation and the re-engineering of the organization in line with the Italian Digital Administration Code.

B. "Regione Lombardia"—Integrated Management of the Land

The Lombardia Region selected the inter-municipalities service (SIGIT), which supports integrated management of the land, as the most interesting best practice in the region in the area of inter-administrations collaboration. The SIGIT project aims to build an integrated geographical database starting from city maps. Cadastral and demographics data can be directly integrated to easily support real needs of the administrations in the activity of controlling and managing territorial data.

For what concern monitoring of the requirements the SIGIT project implements both communication and collaboration level of **coordination**. Processes that are implemented in the system are standard defined by the Region and they are shared by the involved administrations. Collaboration among administrations is supported by applicative cooperation infrastructure. The **control** is mainly reactive and the users have to be aware and have to start the interaction with the system; only few services can be typed as proactive. With respect to the **sharing** perspective this is implemented thanks to specific agreement with the municipalities, which are the owners of the data. **Transparency** has been implemented toward civil servants and **inclusion** refers to on-line presence. Finally for what concerns the **simplification**, novel rules and processes have been introduced. In particular, a regional law simplifying the governance of the lands has been approved.

C. "Regione Sicilia"—Integrated Management of the Land

The Sicilia Region selected the regional information system, built to support integrated management of the land, as the most interesting best practice in the Region. The project aim is to create a shared and federated infrastructure to avoid data incontinuity. The infrastructure enables service according to standard procedure and workflow technology allowing a good level of service reliability via an administrative and technical validation. For what concern the different areas of application we refer to social development, tourism, urban planning and environment protection.

The project implements at different levels the requirements we consider relevant in our monitoring. Coordination and semantic integration have been implemented for what concern **coordination** thank to the applicative cooperation infrastructure and the use of ontological schemas. The **control** perspective is classified according to a creative level thanks to the ability of the system to offer value-add services after the use of basic ones. The system logically shares information that is distributed among the administrations in charge by law to manage them. Role **transparency** is

implemented just for what concern services directly related to the citizens. **Inclusion** is supported by a multi-channel approach able to integrate different technologies. **Simplification** is at the base of the overall system in order to reach the wider number of users as possible.

D. "Regione Sardegna"—Information System to Support Integrated Management Municipality e-Government Service

The Sardegna Region selected the Comunas project. It implements the one-stop shop approach to integrate and promote innovation in the community of local administrations. It involves 377 municipalities with the aim of building a modern integrated information system to facilitate the delivery of e-government services to citizens, companies and other organizations in the areas of demographic, tax and financial sectors. The project focuses on the following three aspects taking care both technical and organizational issues: a regional portal as a single point of access to the integrated system, an architecture to support interoperability of the municipalities information systems, and the creation of a community to contribute with value-added services.

Related to the **coordination** Comunas implements cooperation since it is based on an integrated architecture to support interoperability of the information systems. The access policies are automated and controlled by a centralized system. **Control** has been implemented according to the service and explores the potentialities of the shared approach in e-government, doing so tracking on the process is supported in order to implement transparency. **Data sharing** has been implemented in line with the responsibility of the different PAs. **Inclusion** on the profile and multi-channel gateway from citizens to public authorities are implemented. For what concern the **simplification** it refer both at technology and procedural rationalization reviewing procedural patterns. New law has been introduced in the Region making explicit guidelines on citizens related data management.

E. "Regione Friuli Venezia Giulia"—Regional Service Card

The Friuli Venezia Giulia Region selected the regional service card as the most interesting best practice focusing on e-government enabling infrastructure. The project developed within the framework of the regional and national policies which foster the use of smart cards with a view to providing a single digital identity tool to be used not only for identification purposes but also for accessing a series of on-line services via web portals and/or dedicated desks across the region. The Regional Service Card, which guarantees total compliance with privacy regulations and the protection of personal data, is the result of an institutional agreement between the Friuli Venezia Giulia Region and the Central Government, and it has been conceived to perform three main functions nationwide: Health card, European health insurance card and Tax code. In the Friuli Venezia Giulia Region, however, it also works as a Regional Service Card, allowing citizens to use services pertaining to: health, local government and regional authorities.

The proposed monitoring has been done on the health care services enabled by Regional Service Card domain based on

an Intranet/Internet system allowing the integration of medical data concerning services provided by hospitals to citizens through a Web Portal. Health care services are based on a shared technical infrastructure for applicative cooperation considering shared data infrastructure following national standards. Doing so it implements collaboration level of **coordination** and **data sharing**. Profile **inclusion** is supported by a wide range of services focusing to take in the most of the citizens considering legal, moral, rational and empirical factors. Finally **simplification** enables the coexistence of traditional and innovative methods implementing functional activities geared at supporting the start-up of new services.

F. "Regione Umbria"—Cadastral Echographic System

The Cadastral Echo-graphical System is one of the Regione Umbria projects in the area of e-government. It intends to decompose and reassemble at regional level the echo-graphic data held by the municipalities in the region using the applicative cooperation infrastructure and Geographical Information System technology.

With respect to the **coordination** Umbria Region integrates and improves the existing local Territorial Information System that manages the Cadastral Echo-graphical Information, attaining one's regional standard of applicative cooperation. Doing so the **control** is managed at back-office level thanks to the event management system. For what concern the **sharing**, the project realizes an informative layer useful for the municipal and cadastral information integration evolving the technological architecture of the Territorial Information. **Transparency** is implemented via the infrastructure formalisation of service agreements, which makes it possible to define interfaces, behaviours, quality and security requirements and linkages with domain ontology. **Simplification** is introduced at organization level thanks to the introduction of an integrated infrastructure.

G. "Regione Basilicata" - e-Health Information System

The Basilicata Region refers to the regional e-Health Information System as the most interesting best practice in the area of process re-engineering. The project called LuMiR aims to support the changing environment in the Italian National Health Systems, embodying a shift from organisation-centric to patient-centric services in the Basilicata Region [15]. The primary objective of the LuMiR project is to foster collaborative, cross-organizational and patient-centric healthcare processes, supporting them with a suite of digital services for patient related clinical information communication and sharing among active stakeholders. It also aims to provide ICT support for other business activities. The LuMiR system design and development follow a three-phase development process adopted to comply with institutional constraints and to better support a gradual change in the daily working practice of healthcare professionals called to use ever more sophisticated healthcare applications.

According to the monitoring approach proposed in this paper the LuMiR project contributes with a best practice of use **applicative cooperation** infrastructure in e-health domain. Specific service level agreement and policy are introduced to support interoperability among different

involved parties focusing on applications that are spanning throughout the whole healthcare delivery. **Data sharing** is critical according to the domain of interest, sensible data are managed and privacy issues have been considered. In particular, documents compliant with the HL7 are at the base of the system as well as other results from standardization activities. For what concern the **simplification** the evolutionary, iterative and incremental approach allow among others to consider a socio-technical perspective based on the e-health ecosystem. **Control** and **transparency** are supported by some services.

H. "Regione Liguria"—Integrate Cadastral Echo-Graphic Services to Support Management of the Land

Liguria Region presents SIGMATER as the most interesting project in the area of applicative cooperation. It aims to create an infrastructure to exchange and integrate regional cadastral information. The purpose of the project is to improve planning, administrative and management capabilities in matters concerning property and property taxation. This infrastructure enables the development of services for private citizens and businesses and it provides support in the use of local property registers and in the management of local property taxation. The project contributes to the improvement of the perceived quality of a service by citizens and enterprises, which need to match cadastre information (managed by regional agencies) with regional information (handled by regional and local authorities). Service implemented in such area are Cadastral information to citizens, professionals, public authority, metadata services, download services, gazetteer services, services with fiscal information.

For what concern the requirements monitored the project implements the collaboration level of **coordination** (with legal and administrative value) in compliance with the technical detailed lists of cooperation and interoperability of National Centre for Information Technology in Government. Related to the **sharing** it implements the decentralisation process transferring the responsibility on the cadastral data from the national administration level to the local level and in particular to the municipality. The services are supported both in term of **inclusion** and the activity and roles **transparency**. Finally, **simplification** is enabled by the project thanks to the fully adoption of the national digital law.

VI. DISCUSSION AND CONCLUSION

This paper presents the evaluation of eight case studies of government service provided by regional administrations. They provide context information to explore the role of applicative cooperation in the local Public Administrations.

Innovation in Public Administrations can play a very important role in the development of the country. This is where the greatest gains in efficiency and effectiveness are achieved. Governing Public Administration innovation policies, by incorporating knowledge gained through monitoring and evaluation, shows the ability to enhance the investments made in the past and allows recognizing best practices in key areas of development (e.g. e-Health and mobility).

Based on such context, the development of service already under way or just planned; have to focus on the stakeholders' community as enabler of the innovation in the Public Administration. Community resolves the complexity of digital innovation within the territory. Citizens, businesses, intermediaries (doctors, teachers, accountants, engineers, architects, etc.), local authorities and their combinations (Local Services Centres, municipalities, mountain communities, etc.), universities and research centres contribute, each with its own role, to the creation of such a community. The role of the intermediary is not to be underestimated; they are able to mediate among the administrations and citizens. By doing so, the impact of innovation in Public Administration can be improved resolving those critical issues that could create a gap among potential users.

From a technological point of view the case studies introduce some interesting discussion points. Public Administration portals offer a single access point to services that can be also interactive. The spread of broadband, the deployment of digital identity and the diffusion of applicative cooperation infrastructures [16] represent basic elements in the PA innovation process as well as shared registry data, documents dematerialisation and digitalization. Finally, process reengineering contributes to the revolution of Public Administrations traditional management mode and it breaks the limitations of such a kind of management.

The complexity of the scenario discussed in this paper confirms the benefit of systematic analysis and assessment in order to maintain a complete and updated view on the actions taken by Public Administrations, which can present different levels of maturity. Some innovative and successful cases impact both on the community and on the internal organization of the administration. Other innovative cases, although not fully mature yet, can reach potential users via training and communication actions. Finally, experimental cases have been identified when the actions involve only part of the potential community and show the potential impact of the project.

Generally speaking, the systematic evaluation contributes to increase awareness of Public Administrations introducing innovation. We believe that via a plan-do-check-act approach it is possible to promote sustainable development of Public Administration.

These lessons have been developed by the authors in order to help improve monitoring and evaluation practices in Public Administrations and it calls for senior executives and policy makers to engage more with the e-government agenda.

ACKNOWLEDGMENT

The authors would like to thank "Regione Marche" and "Centro Interregionale per il Sistema Informatico ed il Sistema Statistico" for coordinating and partially funding this research work.

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